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AICPA ACCOUNTING RESEARCH BULLETIN NO. 44

By

Paul T. Norton, Jr.*

When the American Institute of Accountants (now American Institute of Certified Public Accountants) Committee on Accounting Procedure issued Accounting Research Bulletin No. 44 in 1954, the members of the Committee doubtless believed that the statements in this bulletin would be accorded the authority of generally accepted accounting principles. This has certainly not proved to be the case with two of the more important topics, which are (1) that it is proper to reduce taxes by using one of the new methods of the 1954 Code while continuing to show lower depreciation (and higher profits) on the books, and (2) that in most cases where the greater depreciation is taken for taxes only, it is not necessary to give accounting recognition to deferred income taxes.

In the Journal of Accountancy (and to a lesser degree, in other accounting, tax, and business periodicals) there have appeared many items attacking the second of the two topics mentioned above, and some letters which indicated that the writers did not understand what the bulletin signified with respect to this topic. While few persons seem to have specifically attacked in print the first of these topics, in which it was stated that it was good accounting practice to take more depreciation for taxes than for the books, I am convinced that it is this particular procedure that will bear the brunt of the attack that seems sure to come the next time consideration is given to general tax revision by the Congress. Ever since the

* Professor Norton has written over sixty papers on depreciation and engineering economy. He has written and spoken on tax matters, particularly depreciation, for many engineering and other professional periodicals and organizations.

1954 changes, important groups have been assailing the depreciation liberalization as an unwarranted gift to business. Practices authorized by Bulletin No. 44, and utilized by many important corporations, will permit anti-business spokesmen to charge rather effectively that all that big business really wanted was to reduce its taxes, while continuing to claim the same high profits of pre-1954 years on reports to stockholders, through taking the greater depreciation allowances of the 1954 Code for taxes only.

Available published evidence proves that the managements of many large corporations actually did contrive to "have their cake and eat it too" by taking the increased depreciation allowances of the 1954 Code for taxes only. Some of these corporations gave accounting recognition to this practice by setting up reserves for deferred taxes, but many of them took advantage of the language of Bulletin No. 44 and gave no accounting recognition to the fact that the greater depreciation allowances had been taken for taxes only.

1958 REVISION OF BULLETIN NO. 44

Apparently there were many protests both by CPAs and outsiders against what I have been calling topic 2 of Bulletin No. 44, under which the corporations last mentioned in the preceding paragraph gave no accounting recognition to the fact that they were taking more depreciation for taxes than for the books. However, it was attacks on this practice by the SEC that seem to have provided the compelling reason for the 1958 revision of Bulletin No. 44, which stated that in all cases where the amounts were material, accounting recognition should be given to the effects of taking more depreciation for taxes than for the books. Also, that the effects of such accounting recognition should be shown retroactively for all years after 1953. Many companies complied with the revision by setting up reserves for deferred taxes on their 1958 annual reports, and in at least some cases showing the effects retroactively, although there

seem to be differences of opinion as to just what the retroactivity provisions of the revision really meant.

The 1958 Annual Report of one large company gives some very interesting information with respect to the effects of the revision of Bulletin No. 44. In its 1957 Annual Report, this company had shown 1957 net income of $45+ million, while the restatement of 1957 net income in its 1958 Annual Report showed only $42+ million, a reduction of $3,200,000 in 1957 net income. A note in the 1958 Annual Report calls attention to the revision of AICPA Accounting Research Bulletin No. 44 and explains that this revision was the reason for the reduction in 1957 net income. The 1958 Annual Report showed 1958 net income of $46+ million with a note stating that this net income was approximately $3,300,000 below what it would have been without the bulletin revision. While the revised bulletin calls for accounting recognition of differences between taxable income and book income, it contains a statement to the effect that this recognition may be given through additional amortization or depreciation instead of making a credit to a deferred tax account. The operating statements for 1957 and 1958 given in its 1958 Annual Report indicate that this company may in 1958 have used the alternative method just mentioned, as these operating statements show a provision for deferred income taxes for 1957 but not for 1958.

For reasons that will be given later in this article, I believe that practically everything contained in Bulletin No. 44, both the original 1954 issue and the 1958 revision, has been based on a complete misunderstanding of the purposes of the depreciation changes of the 1954 Code. The very fact that the AICPA Committee found it necessary to make such radical changes when revising the bulletin in 1958 would seem to indicate that the provisions of the original bulletin had not received as much consideration as the importance of the problem required. Also, the fact that the Committee felt it advisable to issue a letter interpreting the intent of certain language in the 1958 revision, and the legal controversy with respect to the issuance of that

letter, seem likely to reduce the prestige of this bulletin.

EFFECT OF BULLETIN NO. 44 ON REPORTED NET INCOME

In the original (1954) issue of Bulletin No. 44, the AICPA Committee on Accounting Procedure stated that ordinarily it was not necessary to recognize deferred income taxes in the accounts when more depreciation was taken for taxes than for the books. In the 1958 revision of this bulletin, the Committee reversed itself in this respect and stated that recognition of deferred taxes is required if there is to be an equitable matching of costs and revenues, and income distortion is to be avoided. The Committee also stated that its studies indicated that where more depreciation was taken for taxes than for the books, most companies did give some sort of accounting recognition to the effects of such practice. I am perfectly willing to accept the Committee's statement as to this point, but there is ample evidence that those companies taking more depreciation for taxes than for the books, and not giving any sort of accounting recognition to the practice, included a considerable number of our largest corporations.

I am convinced from discussions with some top financial executives that the managements of the companies that did not give accounting recognition to the effects of taking more depreciation for taxes than for the books honestly believed that they were merely following for the books the depreciation practice they had been using prior to the enactment of the 1954 Code. That certainly was not true with respect to the book net income reported to their stockholders. It will be remembered that when the 1957 book net income was restated for the company mentioned earlier in this article, so as to comply with the revision of Bulletin No. 44, the 1957 book net income was reduced by $3,200,000 from the figure previously shown in the 1957 Annual Report. This $3,200,000 was the current (1957) reduction in income taxes that resulted from taking more depreciation for taxes than for the books. The book net income of $42+ million was the net income

for 1957 that would have been shown under the pre-1954 depreciation practice, when straight-line depreciation was used for both taxes and the books. In other words, under the practice authorized by the original (1954) Bulletin No. 44, this company not only reported to its stockholders the higher book net income that resulted from taking the lower straight-line depreciation for the books, but actually added to this higher book net income the $3,200,000 current (1957) saving in income taxes resulting from taking the higher depreciation of the 1954 Code for taxes only.

It will be noted that even after restating the 1957 book net income to comply with the revision of Bulletin No. 44, this company still used the lower straight-line depreciation allowances for computing book profits, and at current tax rates it would seem that on its 1957 income tax return the company must have claimed some $6 million more depreciation than the approximately $31 million shown for depreciation items for 1957 in both the 1957 Annual Report and the restatement of 1957 net income shown in the 1958 Annual Report. To put it still another way, if this company had deducted on its books the same amount of depreciation it claimed on its tax return, the book net income for 1957 would have been only something like $39 million, instead of the $45+ million originally reported which became $42+ million in the restatement due to the revision of Bulletin No. 44.

I am convinced that the management of this large company believed that their book net income for 1957 was $45+ million when they issued their 1957 Annual Report, and also that they believed this 1957 book net income was only $42+ million when they made the restatement for 1957 in their 1958 Annual Report, after Bulletin No. 44 had been revised; but I am also convinced that the managements of this company and the many others who have followed the same depreciation tax practice will find it very difficult to convince the general public that such actions were taken in good faith. Of course, the entire affair originated

with the taking of some $6 million more depreciation for taxes than for the books, plus the fact that in the original statement of 1957 book net income on the 1957 Annual Report this company actually added in the saving in income taxes that resulted from taking the greater depreciation for taxes only.

The revised bulletin was published in the August 1958 issue of the Journal of Accountancy and an editorial in the same issue makes the interesting observation that an important factor in the decision of the Committee to revise Bulletin No. 44 was the number of companies that did not use the same depreciation method for both taxes and the books. Frankly, I am not surprised that so many persons seem to be confused as to just what the Committee did mean in either or both versions of this bulletin. Surely, if the position taken by the Committee in 1954 was correct, the Committee should have been perfectly satisfied to have all companies follow the original Bulletin No. 44. In addition, there is absolutely nothing in the 1958 revision of the bulletin to indicate that the Committee even now has the slightest objection to the practice of taking more depreciation for taxes than for the books; the revised bulletin merely requires that when this is done, some sort of accounting recognition be provided.

It may well be asked: "Where did the AICPA Committee on Accounting Procedure get the authority to sanction the use of the additional depreciation of the 1954 Code for taxes only?" There is certainly nothing in Section 167 of the Code on Depreciation, nor in the Depreciation Regulations, to sanction such a procedure. In fact, Section 446 of the Code specifically states: "Taxable income shall be computed under the method of accounting on the basis of which the taxpayer regularly computes his income in keeping his books." The exceptions given in the Code to the General Rule just quoted certainly do not apply to the situations covered by Bulletin No. 44. Discussions with many financial executives who have convinced their managements that it is proper to take more depreciation for taxes than for the books, and with CPAs who approve this practice, have convinced

me that these men honestly believe that straight-line depreciation is the only proper method to use for calculating book profits, and that the purpose of the changes of the 1954 Code was merely to provide a tax incentive so as to increase investments in depreciable assets. That these men have completely misunderstood the purpose of the 1954 liberalization can readily be proved by merely reading the reports of the House and Senate committees. When I have called attention to these committee reports, I have been shocked to learn that these able men have made their decisions on such an extremely important problem without even reading them.[1]

Those persons who believe it is proper to take more depreciation for taxes than for the books might well study an editorial in the June 1956 issue of the Journal of Accountancy, part of which is quoted in the article mentioned in Footnote 1, which states clearly three points that certainly cannot be reconciled with Bulletin No. 44: (1) that when the 1954 liberalization was being considered by the Congress, businessmen strongly maintained that actual depreciation was greater than straight-line depreciation in the early years of life; (2) that some persons have criticized the 1954 liberalization as a gift to business; and (3) that if the practice of taking more depreciation for taxes than for the books became widespread, the Congress might consider repealing this section of the Code. It should be noted that this editorial was published in the official journal of the AICPA nearly two years after Bulletin No. 44 was issued in its original form.

DIFFICULTIES ENCOUNTERED IN SECURING 1954 DEPRECIATION LIBERALIZATION

During the twenty long years from 1934 to 1954, when we were

[1] Quotations from these committee reports and other important information on this entire problem may be found in an article by me: "A Sequel to 'An Engineering Viewpoint on Depreciation Accounting'", Journal of Accountancy, June 1958.

seeking relief from the depreciation tax practice under Treasury Decision 4422, I was told by many prominent men in Washington, in both the Treasury and the Congress, that my arguments for relief were sound but that the arguments used by practically all representatives of business, especially those who were high financial executives, indicated that these men really were interested only in lower taxes. There can be no doubt that these financial executives honestly believed that depreciation tax practice should be liberalized but unfortunately they were so obsessed with the supposed correctness of straight-line depreciation for calculating profits that they could not provide arguments that seemed convincing to the government officials. (At least one of these government officials even predicted that if we got depreciation liberalization, many taxpayers would take the additional depreciation for taxes only; a prediction which seemed incredible at that time but which has actually happened under Bulletin No. 44.)

ARGUMENTS THAT RESULTED IN DEPRECIATION LIBERALIZATION OF 1954

By 1954, there were two changes that finally resulted in the depreciation liberalization of the 1954 Code. In the first place, we finally had Republican control of both the White House and the Congress. What was just as important, business interests had finally begun to use arguments that seemed to the Congress to be more sound than those used previously by businessmen who asked for liberalization while at the same time betraying an underlying conviction that the straight-line method was the only correct method to use in calculating book profits.

The reports of the House and Senate committees prove that victory was finally won in 1954 through two principal arguments:

(1) That depreciation deductions under the straight-line method were inadequate and that they overstated profits. (In this argument, no distinction was ever made between book profits and taxable profits, and those eminent CPAs who fought against accelerated depreciation throughout the entire campaign did not

suggest, as an alternative, that the law should be changed so that more depreciation might be taken regularly on tax returns, with straight-line depreciation being continued for computing book profits.)

(2) That there would be no permanent loss of tax revenue, because total depreciation deductions would continue to be limited to the total investment so that the larger deductions in the early years of life would be offset by smaller deductions in the later years of life.

The 1954 changes followed closely the recommendations made in a book[2] published in 1949, and revised in 1955 to consider the effects of the 1954 changes; and the reasons given by the House and Senate committees for making the changes followed closely the reasons given in this book.

FUNDAMENTAL BASES OF ACCOUNTING RESEARCH BULLETIN NO. 44

As originally issued in 1954, Accounting Research Bulletin No. 44 was based on two points that were exactly the opposite of the two points just mentioned on which the Congress based its decision to liberalize depreciation tax practice. Bulletin No. 44 was based on the premises:

(1) That depreciation deductions under the straight-line method were adequate for use in computing book profits.

(2) That, in the ordinary situation, it was good accounting practice to use accelerated depreciation for taxes only, and without giving accounting recognition to deferred taxes, because the current decrease in taxes would be lost forever by the government! Few CPAs or financial executives of companies who took advantage of this portion of Bulletin No. 44 seem to have understood fully the implications behind the reasoning of the Committee with respect to this point. However, it is the only possible basis for

[2] E. L. Grant and P. T. Norton, Jr.: Depreciation. The Ronald Press, New York, 1949. Revised Printing 1955.

this part of the bulletin, and it is spelled out in practically these words on page 743 of the December 1954 issue of the Journal of Accountancy, in an article on the new bulletin by the AIA Research Department.

It should be noted that even in its revised form Bulletin No. 44 still authorizes as good accounting practice the use of more depreciation for taxes than for the books. However, the opposition of such groups as the SEC has resulted in a revision that has eliminated the most fantastic result of the original bulletin, the increase in stated book net income that resulted from the addition of the saving in current taxes to a stated book net income that was already higher because it was the result of using lower depreciation for the books!

REAL SIGNIFICANCE OF BULLETIN NO. 44 DIFFICULTIES

As stated earlier in this article, an editorial in the August 1958 issue of the Journal of Accountancy observed that an important factor in the decision of the AICPA Committee to revise Bulletin No. 44 was the number of companies that did not use the same depreciation method for taxes and the books. However, the revision did not consider that point at all and merely stated that some sort of accounting recognition should be given when the same method was not used for taxes and the books. Thus what seems to me to be the fundamental error in the bulletin still remains, and the revision merely eliminated a fantastic situation by means of which reported book net income was still further increased without stockholders even being told that there was a difference between tax and book depreciation. The SEC could hardly do more than it has done through requiring that accounting recognition be given, but I believe that the general public will almost certainly demand that the 1954 liberalization be repealed unless corporations cease taking more depreciation for taxes than for the books. It seems to me that the real significance of the difficulties being experienced with Bulletin No. 44 lies in the fact that both those CPAs who wrote the bulletin and those

financial executives who persuaded their managements to take more depreciation for taxes than for the books are far removed from the actual assets being depreciated. To both of these groups, depreciation is merely a lot of figures on some pieces of paper. The older men in both groups, and they are the ones who make the decisions or recommendations, have in most cases not put depreciation figures on the books for many years, but they remember that they used to employ what they called "straight-line" depreciation. They rarely understand that the method they used to call by that name was not really straight-line depreciation at all, but in fact was much more like the accelerated methods authorized by the 1954 Code. Until these misconceptions are eliminated, it is hardly possible to get depreciation practice on a sound basis. Of course, these misconceptions were among the main reasons why it took twenty years to get the liberalization of 1954.

EXTENT OF REVENUE LOSS DUE TO 1954 LIBERALIZATION

Ever since the 1954 Code was enacted, there have been many charges that the depreciation liberalization was nothing but a "gift to business". The fact that so many corporations have reduced their taxes by taking the additional depreciation for taxes only will certainly intensify the demand for repeal of the 1954 depreciation liberalization when the Congress next considers tax revision, probably early in 1960. The revision of Bulletin No. 44 may be expected to increase the demand for repeal because of the added attention that has been directed to the practice of taking more depreciation for taxes than for the books. It is difficult for me to see how this demand for repeal can be defeated under present circumstances, unless businessmen promptly undertake an educational campaign that will result in the elimination of the present practice in so many corporations of taking more depreciation for taxes than for the books. After businessmen have gotten their own house in order, it will be necessary for them to convince the average taxpayer that the 1954 depreciation

liberalization was desirable and should be retained, even though it has reduced taxes for business at a time when the government is telling these individual taxpayers that tax revenue needs will make it impossible for their taxes to be reduced.

Probably no one knows just what the loss in tax revenue has been to date because of the 1954 depreciation liberalization, but I have an idea that it has been considerably more than the Treasury at first thought it was. In the fall of 1956 a high Treasury official told me that they had been glad to note that the decrease in revenue for 1954 and 1955 due to the 1954 depreciation liberalization had been considerably less than they had expected. He was visibly shocked when I asked him how they could know at that time what the revenue loss would be for 1954 and 1955, since the Depreciation Regulations, which were not issued in final form until June 7, 1956, specifically provided that any taxpayer could amend his returns to take advantage of the accelerated depreciation provisions of the 1954 Code at any time up to September 15, 1956, and thus obtain refund of the additional taxes paid for 1954 and 1955 because the accelerated depreciation had not been claimed on the original returns. At first this man could not believe that what I told him could be true, but of course it was. Probably many such amended returns were filed for 1954 and 1955.

* * *

THE MAPI URGENCY RATING

By

Myles M. Dryden
Graduate School of Business and Public Administration
Cornell University

The past few years have seen the development of an increasing interest in capital budgeting. Capital budgeting includes a wide variety of fairly distinct topics; they include methods for ensuring an adequate flow of investment proposals, procedures for quantifying the elements of the projects, criteria for ranking and selecting projects, and techniques for post-auditing the results. In addition, there are the problems of determining the supply and cost of funds and the organizational problems of administering the budget. While these are fairly distinct problems, they are not separate. The solution of each problem is, in a sense, dependent upon the solution of the other problems. However, in the absence of a workable, unified general theory of budgeting, the practice has been to treat many of the topics noted above as separate problems.

This article proposes to consider one of these problems: the ranking of projects. The reader is no doubt aware of the existence of the innumerable criteria for tackling this problem. Among the better known criteria are the rate of return, the pay-out-period, and the present value method. There are many variants of these and many other quite distinct procedures. Generally, each criterion aims at producing a ranking of projects which, if followed, gives the best solution. The best solution to what? The fact is that implicit in many of the ranking criteria are objectives which differ from one criterion to another. A broad classification distinguishes those which attempt to maximize a ratio of revenues to costs from those which attempt to maximize the difference between revenues and costs. Not only do the objectives of the various ranking criteria differ; the data required to compute them differ too. Typically, however,

the ranking is based on information with respect to the initial investment, the salvage value, and the expected net earnings over the life of the project.

Specifically, this article deals with the consideration of one of the more recently devised ranking procedures, and perhaps one of the less familiar. George Terborgh, already well-known in the business world for his work on equipment replacement,[1] has recently completed a book[2] which deals with many of the capital budgeting problems listed above. We shall consider the ranking criterion which he advances in his new book, examine the assumptions, and evaluate it as an investment ranking criterion.

Terborgh ranks the proposed projects by a measure which he calls the Urgency Rating of a project. The Urgency Rating, he states, "measures the urgency of a project as compared with going on without it for <u>one more year</u>. To be more specific, it derives an after-tax return on the net investment in the project <u>as compared with this alternative</u>."[3] Let us, in the following discussion, ignore the problem of taxes. Their inclusion would serve only to complicate the arithmetic without adding to our understanding. The question arises: What information do we require to compute the Urgency Rating of a given project? Much of the criticism of Terborgh's method is confused. Partly, the criticism is of Terborgh's suggestions as to the appropriate method of evaluating a project's importance <u>given</u> full information on the project; but part of the criticism relates to the <u>assumptions</u> he has made in the <u>absence</u> of complete information. Let us be quite clear on what Terborgh advocates as a <u>theoretical</u> criterion as distinguished from his recommendations in a <u>practical</u> situation.

[1] Dynamic Equipment Policy, McGraw-Hill Book Company, 1949.
[2] Business Investment Policy, A MAPI Study and Manual, 1958.
[3] Business Investment Policy, page 59. Terborgh's italics.

Let us consider his theoretical model first. The Urgency Rating is given by:

U.R. = (First year operating advantage - first year capital consumption allowance + first year capital consumption avoided - tax adjustment) + Net investment

As indicated earlier, we propose to ignore the effect of tax. To simplify the arithmetic, let us also ignore the case in which the proposed project releases capital through the salvaging of existing equipment. The formula then reduces to:

U.R. = (First year operating advantage - first year capital consumption allowance) + Initial investment

In the theoretical case we would know the initial investment and the year by year operating advantage over the life of the project. (The operating advantage is found by comparing the difference between the costs and revenues, with the existing equipment, with the corresponding difference assuming the acceptance of the project. In the remainder of the article we shall refer to this net difference as earnings.) From this we would get two of the elements of the U.R. formula. How do we find the third element, the capital consumption allowance for the first year? Terborgh defines the capital consumption allowance for a given year as the decline in the service value of the project during the year in question. The capital consumption allowance for the first year is based on the capital value as at the beginning of the first year (i.e., the initial cost) and the capital value as at the end of the first year. What is the capital value at the end of the first year? The capital value at the end of the year is based on the difference between the earnings which we received during the year and the interest which the original investment earned. We now lead into the key question: At what rate do we compute this interest? Terborgh's answer: Interest at a rate equal to the investment's rate of return.

Thus, to find the U.R., from the theoretical standpoint, we

need to know the rate of return. This is, of course, derived from the original information (the initial investment and the stream of earnings). Given this third element, the capital consumption allowance, we can find the U.R., which, in this theoretical case, is equal to the rate of return. A numerical example will help to fix the concepts. Let us assume the initial investment is $166.72. The life is four years and the earnings stream is $100, $100, -$100 and $100. The rate of return (i.e., that rate of discount which equates the present value of the earnings to the initial cost) is 10%. The capital consumption allowance for the first year is the difference between the earnings for the first year and the interest, i.e., $100 - $16.67 = $83.33. Hence the U.R. is given by:

$$\text{U.R.} = \frac{100 - 83.32}{166.72} = 10\% = \text{the rate of return}$$

That the equivalence between the U.R. and the rate of return is no mere arithmetical fluke is shown in the Appendix where the relationship is proved algebraically for the general case. Incidentally, the reader should note that the capital value at the end of the first year (or beginning of the second year) is equal to the present value of the remaining elements of the earnings stream capitalized at the rate of return for the whole stream. That is,

Capital value at the beginning of year two = CV_2

$$= \frac{100}{(1.1)} - \frac{100}{(1.1)^2} + \frac{100}{(1.1)^3}$$

$$= \$83.40$$

Finally, it should be noted that the sum of the capital consumption allowances for all years equals the initial investment. In this example, the capital consumption allowances for the four years are $83.32, $91.67, -$99.18 and $90.91. The validity of this property in the general case is shown in the Appendix. This, then, is Terborgh's theoretical approach. It can be modified to

take account of the effect of taxes, debt interest (where part of the actual investment is financed by debt) and various methods of depreciation. But the basic results noted above would remain unchanged except that the U.R. would equal the rate of return computed for after-tax earnings.

When we turn to the practical application of computing the U.R., we find that, in general, it is not equal to the rate of return. The basic difference between the practical and theoretical computations is a reduction in the required information. We now need to know only the initial cost, the first year earnings, and the economic life. The price we pay is the substitution of a standardized earnings stream and an arbitrary interest rate. Provided we are willing to specify the shape of the earnings stream and to accept the arbitrary rate, we can find the capital consumption allowance for the first year as a percentage of the initial capital value (not necessarily equal to the initial investment) and hence find the U.R. Because of these two assumptions -- a systematic pattern of earnings and a fixed interest rate -- it is possible to derive a formula which will yield the capital consumption allowance figure described in the previous sentence. Terborgh has set these equations in the form of charts which permit rapid calculation of the capital consumption allowance. The charts permit us to select from a choice of three earnings patterns. Their shapes and characteristics are indicated in Figure 1.

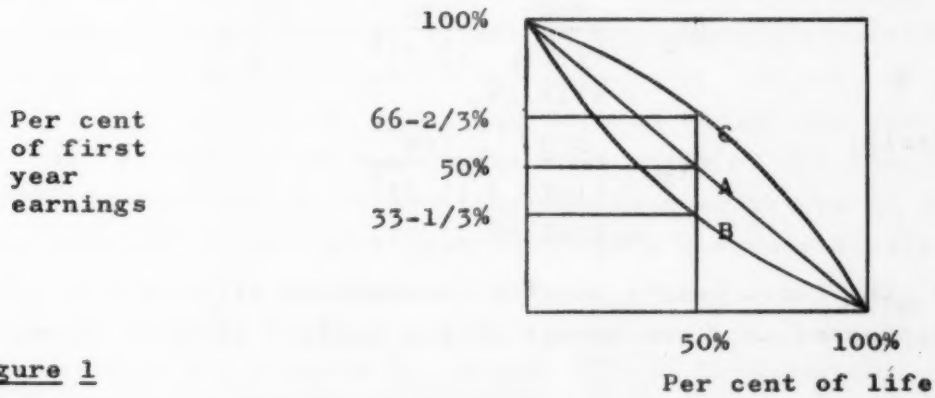

Figure 1

The reader will note that in all cases the earnings pattern decreases over time. But there is nothing inherent in Terborgh's method to prevent the addition of three similar projections which increase over time.

Continuing our examination of the practical case, we must now consider what the computation of the U.R. requires. We are required to provide four pieces of information: (1) the initial investment, (2) the first year earnings, (3) the economic life and (4) the earnings pattern (A, B or C). Again a numerical example may help to elucidate the procedure. Let us assume that we provide the analyst with the following figures: $400 initial investment, $300 for first year earnings, 3 years life and projection Type A. Using the last two pieces of information the analyst can find from Terborgh's charts that the capital consumption allowance for the first year is equal to 48% (approximately) of the initial capital value. Using this percentage and the first two pieces of information, the analyst can compute the U.R. as shown below. What the chart in effect does is to go through the procedure we outlined above for the theoretical case, but using an assumed rate of return and an assumed time shape for the earnings. Specifically, the chart makes the following calculation. Having specified the first year earnings and the shape of the earnings together with the life, we can say that the stream of earnings is $300, $200 and $100. Since the chart assumes a 10% rate of return, then the initial capital value is given by:

$$CV_1 = \frac{300}{(1.1)} + \frac{200}{(1.1)^2} + \frac{100}{(1.1)^3}$$
$$= \$513.14$$

Similarly,

$$CV_2 = \frac{200}{(1.1)} + \frac{100}{(1.1)^2}$$
$$= \$264.46$$

Hence, the first year's capital consumption allowance is $248.68 and expressed as a percentage of the initial capital value, 48%

(approximately). The reader will have noted that we have apparently used one more piece of information than required by the chart, namely, the first year earnings. Our answer, however, is a percentage and is independent of the actual dollar figures. The answer would be 48% for a stream equal to $3, $2 and $1. The point is that, given the two pieces of information, life and shape, we can deduce that the stream is of the form 3k, 2k and k. The reader can verify that the capital consumption allowance, as a percentage of initial capital value, is independent of k.

The next step is for the analyst to use the fourth piece of information, the initial investment, which gives the following value for the U.R.:

$$U.R. = \frac{300 - .48(400)}{400} = 27\%$$

By way of comparison, the reader can verify that the actual rate of return is close to 29%. It is only in the case of projects whose rate of return is equivalent to the rate assumed by the charts that the U.R. is equal to the rate of return.

The reader will no doubt have surmised from the foregoing discussion that the U.R. when used as a ranking criterion will give little variation from the ranking given by the rate of return. This is indeed true. The ranking given by the two methods is identical in most uses. It is always identical where the lives of the projects under consideration are equal. The writer sees no appreciable benefit in substituting this technique for the rate of return; it has all of the defects of the rate of return, and some more in addition, and it has no appreciable advantages over the rate of return. Some of the defects of the rate of return method are, of course, virtually defined out of the problem through the assumption concerning the time shape of the earnings. Thus, for example, the criticism that the rate of return is not a unique concept[4] is not pertinent here since the possibility of

[4] James H. Lorie and Leonard J. Savage: "Three Problems in Rationing Capital", Journal of Business, Vol. XXVIII, No. 4, October 1955.

multiple rates of return can only arise if we admit the possibility of negative earnings. Clearly this defect is not possible given Terborgh's assumptions that earnings follow a systematically decreasing time path and terminate to zero. (In his most general equations Terborgh does make provision for scrap value. In this case the earnings terminate to a value equal to the scrap value.)

The assumptions concerning the time shape of the projects are restrictive. Many projects have increasing earnings. Many other projects have earnings patterns which have maximum or minimum values, while there are others which behave in a completely erratic manner. While charts could be computed to incorporate systematically increasing earnings the method could not be adjusted to include erratic patterns of earnings.

The U.R., like the rate of return, does not help us to distinguish the best investment in the case of mutually exclusive projects. If we must select A or B, A having a high U.R. but based on low initial investment, while B is the converse, then the U.R.s, by themselves, do not help us to select the correct alternatives. It would seem that, given the information required for the computation of the U.R., that is, the initial investment, the earnings in the first year, the life and the expected pattern of earnings over time, we could use this to find the present value of the earnings and hence the "net profit". These net profits could then be used to rank the projects. This latter method would, of course, require us to decide upon an appropriate rate of discount, the cost of capital. This rate would be different from one company to another and would be equal to the rate assumed by Terborgh only by chance.

APPENDIX

Let the initial cost of the project be CV_1. Let the stream of earnings over the n years of life be x_1, x_2, ... x_n. Then the rate of return, r, is defined by:

$$CV_1 = \sum_{k=1}^{n} \frac{xk}{(1+r)^k}$$

$$\text{In general } CV_t = \sum_{k=t}^{n} \frac{xk}{(1+r)^k} - t + 1$$

The capital consumption allowance for year t is CC_t, where

$$CC_t = CV_t - CV_t + 1$$

$$= x_t - rCV_t$$

Specifically, for the first year, the capital consumption allowance is $CC_1 = x_1 - rCV_1$.

Hence, since the U.R. is given by:

$$UR = \frac{x_1 - CC_1}{CV_1}$$, then, substituting the value for CC_1 above we find that the U.R. equals r.

Note also that the sum of the capital consumption allowances over the life of the asset is equal to the initial capital value.

$$\sum_{t=1}^{n} CC_t = \sum_{t=1}^{n} (CV_t - CV_t + 1)$$

$$= CV_1 - CV_2 + CV_3 \ldots + CV_n - CV_n + 1$$

$$= CV_1, \text{ since } CV_{n+1} \text{ equals zero.}$$

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AN ANALYSIS AND EVALUATION of the JONES AND LAMSON "AVOIDABLE COSTS" REPLACEMENT FORMULA*

By

George F. Weston
Anheuser-Busch, Inc.

In the spring of 1959, the Jones and Lamson Machine Company of Springfield, Vermont published what is called the "Avoidable Costs" Replacement Formula in a twelve-page booklet. The booklet criticizes such commonly used replacement formulas as the rate of return on investment, the favorable-cash-flow concept and the fast payoff, in terms of what are considered to be their major limitations. The chief limitations of these formulas, according to the booklet, are:

(1) The arbitrary selection of a rate of return or favorable cash flow or period of time for payoff.

(2) The avoidable costs that will be incurred if the decision to replace is postponed due to the arbitrary standards set in (1).

(3) The fact that most replacement formulas do not provide for savings over the life of the new equipment.

As a result, the publication contends, these formulas do not consider the inflationary trends for operating costs, chiefly labor and materials, and capital equipment costs. To remedy these deficiencies, the Jones and Lamson formula builds into its computations "projections of increases in labor and other costs for these periods of time and also a projection of the increase in price of the new equipment for similar periods of time".

In this analysis we will first develop the algebraic formula representing these ideas, then analyze this formula, and

* The formula can be obtained without cost by writing the Jones and Lamson Machine Company, Springfield, Vermont.

finally, view the simplifying assumptions that must be made when using the formula.

Let n = the number of years beyond the first year

Let N = n + 1 = the number of years from today

Let S = avoidable costs or net savings if installed

Let K_1, K_2, ... K_n = inflation factor for labor and material

Let F_1, F_2, ... F_n = inflation factor for machinery

Let C = investment or cost today

Then,

$$\text{Ratio of savings to costs} = \frac{S + Sn + SK_n + CF_n}{C}$$

$$= \frac{S\ (1 + n + K_n) + F_n}{C}$$

$$= \frac{S}{C}\ (N + K_n) + F_n$$

However, if we assume that the economy of the country will remain constant and not be inflationary, then factors $K_n = 0$ and $F_n = 0$. The Jones and Lamson formula becomes,

$$\text{Ratio of savings to costs} = \frac{S}{C}\ (N)$$

which is obviously a savings to cost ratio multiplied by the useful life of the equipment or the number of years that we postpone making the investment. This clearly is the most simplified version of the "Accounting Method" of investment analysis. If the inflation factors K_n and F_n are allowed to enter the picture once again, we see that they merely apply a time shape to the ratio in a manner which, it is assumed, will represent the future inflationary characteristics of the economy. This view is contrary to that taken in the Improved MAPI System and (generally) the Investor's Method, both of which apply a declining savings factor over the useful life of the project. The latter reasoning is much more realistic since the first year's savings, in most cases, will not be equal to succeeding years'

savings for the same reason that equipment is replaced. What the Jones and Lamson analysts apparently fail to recognize is that once the machinery is purchased and the avoidable costs are avoided for the old equipment, new avoidable costs (increasing maintenance, increasing power consumption, etc.) immediately appear for the newly purchased equipment.

The above insight into the reasoning behind the Jones and Lamson Formula will be expanded by investigating some of the simplifying assumptions which must be made when utilizing the formula.

(1) The economy of the country will continue to be inflationary in the foreseeable future.

The decision that we will or will not have an inflationary economy must be a judgment on the part of the management contemplating the capital investment. Naturally, a machine tool company would like to usurp this judgment for sales purposes. However, it does not add to the theory of investment analysis to project the short run past to the future in the manner presented.

(2) Cost of money is not a factor to enter the analysis.

The formula as written does not include any cost of money factor. However, this could easily be incorporated into the Current Cost Comparison portion of the formula.

(3) There is no technological advance.

The formula does not cover the possibility that, if the investor postpones making his investment, a better and more suitable piece of equipment may be put on the market.

(4) There is no "time shape" to savings, operating

expenses, or investment funds.

Other than the inflationary factors, the formula does not take into account the changes in savings, operating expenses and investment, in real dollars, which must take place in any real machinery. The real dollar savings generally decrease with passing years, while the operating costs increase.

(5) Income tax is not a factor.

The complex considerations of expense costs and capital costs, and the varying amounts of these costs in regard to the actual dollar cost to the investor, are not touched upon by the Jones and Lamson Formula.

(6) Depreciation is not a factor.

This ties in with the concept of income tax, since rapid depreciation quite naturally puts the company in a different financial position from slow depreciation. The depreciation allowance for equipment is most often the major decision factor for approval of projects in major concerns.

Other assumptions which need no further comment,but should be listed, follow:

(7) The service lives of the various alternatives in question are accurately known.

(8) The various alternatives of investment will give equal service to the investor.

(9) Current costs are accurately known.

(10) Cost for all alternatives, including installation, maintenance, start-up problems, etc., are accurately known.

The Jones and Lamson Formula is seen to be a rough and ready method of investment analysis. The only claim to improvement over the simplest versions of the Accounting and Payback Methods is the use of inflation factors in the calculations. The drawback to this was brought out in the body of this paper but is important enough to be restated: The concept of unavoidable inflation is not something to be unconditionally accepted because it is published in an investment analysis formula. The direction that the economy will follow is something that must be determined by the management of the investing company in the light of its own experience and knowledge.

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PLANT DESIGN AND ECONOMICS FOR CHEMICAL ENGINEERS*

Book Review

By

J. I. Peters
E. I. du Pont de Nemours and Company, Inc.

This volume is very ambitious in concept and wide in scope. It attempts to introduce the senior undergraduate or the graduate student to the concepts of economics used in industry and to connect the design of equipment with economics. In this it succeeds admirably. One third of the book is concerned with economics such as costs, interest and investment costs, taxes and insurance, depreciation, alternative investments and replacements, cost estimation, and cost and asset accounting. The remaining two-thirds of the book covers design considerations for plants and equipment.

The section on economics can serve as a very good, practical introduction to the field. It will no doubt not please the professional cost engineer; but, after all, it was not meant for him. It could, however, with advantage have been expanded to include a more theoretical treatment of the subject. On the other hand, the design section contains so much extraneous material that it can serve as a refresher for rusty engineers. This was certainly not the purpose, and it is hoped that it will be abbreviated in the next edition.

Because of the brief, practical treatment of economics, many more references, with abstracts of some in the appendix, would be useful. The discussion of the different types of estimates does not contain a listing of the accuracies expected. The names for different estimates differ in different firms, but generally the same stepwise procedure is followed from a

* MAX S. PETERS: McGraw-Hill Book Company, New York, 1958. 511 pp. $11.00

high-spot estimate for development and research purposes only to a final construction cost estimate on which the final decision is based. The accuracy required at each stage varies. The first estimate may be ± 50%, the final one ± 10%. The accuracy obtainable depends upon the status of the technology and knowledge of the equipment required. Certain items, like power and operating labor, can, however, be predicted with fair accuracy from a preliminary flow sheet. These factors balance the more unpredictable items to allow the experienced engineer to arrive at an estimate within the ± 50% range with relatively scanty process data.

The book does not contain a typical mill cost sheet for a product. It might be said that the book is meant for design engineers who will not have to calculate the cost of individual products. Yet the inclusion of discussions on operating labor, depreciation and similar items obviously makes it suitable for the engineer with wider plant responsibilities. Since an industrial firm has the primary responsibility to its stockholders of earning a fair profit on its capital investment, the mill cost sheet is of utmost importance. The operating man has to justify his employment by constantly improving cost performance. The effectiveness of the design engineer's work is also reflected in the cost sheet. The young engineer entering industry gets very confused when faced with cost sheets, frequently with no explanation of the terminology. Professor Peters could, therefore, improve the usefulness of his book by a brief discussion on this topic.

There are numerous arguments advanced by cost engineers for different methods of calculating profitability of investments. Professor Peters mentions them but discusses only the rate of return on investment as a criterion. While this, in the opinion of many writers, is the most widely applicable method, more discussion of the alternatives would be desirable.

The statement "In ordinary chemical plants, working capital amounts to approximately 10 to 20 per cent of the total capital investment" is misleading. It is impossible to generalize since

there are no "ordinary chemical plants". However, to give the student a correct idea, a wider range should be quoted, 10 to 40 per cent, perhaps. If figures are available, they should be tabulated. The values of individual items contained in the working capital and the arguments for their variation should also be discussed. The pharmaceutical industry, for example, uses very different factors from the heavy chemical industry.

Similarly, this volume would be improved by a better discussion of operating labor requirements. A typical job analysis could be added which would give the student an idea of what can be expected from a man. Industry has procedures for gauging job requirements and evaluating the labor costs accordingly. Inclusion of some such data would be useful, if only to prepare the student psychologically for time allowed for coffee breaks, showering, and meetings.

The engineering design section of this book is very good, but perhaps too extensive. The chapter on "The Design Report" contains 22 pages, 10 pages too many. The chapter title "Materials Handling and Transfer Equipment" is a misnomer since it deals almost exclusively with pumps and piping. The addition of basic cost information on materials handling equipment such as hoists, bucket elevators, moving belt and vibratory conveyors, would be very useful to the practicing engineer. The sections on mass and heat transfer equipment are very good. They contain a lot of useful know-how and practical data. The discussion section could, however, be abbreviated.

In addition to problems at the end of many chapters, 24 pages of major problems are appended. It would be useful if answers were supplied to some problems and if at least two of the appended problems were worked out in detail to demonstrate how the discussion in the back can be applied to solutions of larger plant design problems.

The above comments highlight the shortcomings of the book in order to supply constructive criticism which will be useful for a second edition. Such an edition would be well received,

since the book is very good. It contains a good basic, practical discussion of economics in relation to engineering design and will thus be useful to the non-specialist chemical engineer. It contains a wealth of very useful cost information which could be even more useful if better indexed. It is also one of the very few technical books to include a discussion of compound interest with formulas and tables. Because of the practical approach and the ample cost data which are included, this book by Professor Peters will be a useful text as well as a handy reference volume for the practicing engineer.

This reviewer wishes to acknowledge the stimulating discussions on the book with J. H. Norton and C. C. Ballard of the du Pont Company.

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RISK AND TECHNOLOGICAL INNOVATION*

Book Review

By

John Thorkelson
University of Connecticut

Mr. Strassmann' book is a lucid and penetrating summary of the steps by which technological change was introduced in the iron and steel, textile, machine tool, and electric power industries during the nineteenth century.

The work is less comprehensively descriptive and more analytical than its subtitle ("American Manufacturing Methods During the Nineteenth Century") might suggest. Based largely on secondary sources, its purpose is in part to see whether businessmen in general were opposed to innovations, as Veblen asserted, or were the prime movers of technological progress, as Schumpeter claimed. Strassmann concludes that neither view is wholly supported by the evidence. Schumpeter's concept of the daring, gambling businessman turns out to be romantic; in almost no case was a major change introduced until the chance of failure or serious loss had been reduced to negligible proportions. Veblen's view that businessmen habitually blocked the efforts of engineers to innovate likewise is rejected, for entrepreneurs did press for technological change, once persuaded of its profitability, and sometimes against the engineers' advice.

The author's definition of innovation includes both the engineering aspects of changes in manufacturing methods, and the business or commercial problems connected with introducing such change. This is a useful approach, enabling the author to show the caution with which Carnegie's numerous "revolutionary" innovations were in fact introduced. Many earlier attempts to

* W. PAUL STRASSMANN: Cornell University Press, Ithaca, N. Y., 1959. 226 pp. Bibliography. Index. $4.00

improve production methods and quality in iron and steel production appear to have been unsuccessful, not because of the risks involved, but because of an insufficient knowledge of metallurgical chemistry. Once formal educational institutions remedied this gap, the effects of technological change became much more predictable. This in turn made possible firmer calculations of savings and costs, of the type Carnegie insisted on before approving major innovations. Far from being risky, it appears that after 1870 in the steel industry "attempts to innovate led to fewer losses than total refusal to innovate" (page 36).

In marked contrast to the other industries, the great period of innovation in textiles was early; and after 1835 or 1840 a period of "technological conservatism" set in, during which a long series of relatively minor improvements was broken only by the Drapers' automatic loom in the 1890s (and even this major change was developed cautiously and marketed reluctantly). The increasing size of plant and investment in heavy equipment of course explain the reluctance of mill owners to innovate. But although the same barriers to change existed in steel and other industries, their innovation proceeded at an accelerated pace as the century wore on. Strassmann's explanation of the difference rests on his concept of "reciprocal complementarity" or, less clumsily, "interrelatedness" (pp. 205 ff.). The metallurgical, engineering, and electric power industries were able to benefit from each other's innovations, so that frequent windfall profits spurred the pace of change against the drag of entrepreneurs' caution. But for textiles there was no such interrelation. In economic terms, repeated cost-reducing external economies due to innovations more than offset diminishing returns in heavy industries, but not in textiles. Moreover, innovations in the three producer goods industries typically profited from a rapidly growing market (i.e., a more elastic demand) as the American economy's capital structure "deepened", while the market for textiles -- the population -- grew more slowly, so that only minor and

inexpensive changes in methods could be considered profitable. Inter-industry differences in the pace of innovation are thus correctly explained by objective structural factors, not by the subjective personalities of the businessmen concerned.

The weaknesses of the book, aside from an undue number of typographical errors, lie in two areas. One is an overformal classification of types of risk, which leads to a pedantic repetition of the point -- important in itself, to be sure -- that pure gambling-type (uninsurable) risks were not associated to any appreciable degree with the major innovations, at least after the Civil War. A second flaw is a highly problematical and unhelpful discussion of what might have happened to the pace of growth had entrepreneurs more generally realized the possibility of windfall innovation profits, or if technological change had been centrally planned (pp. 208 ff.). "Iffy" questions of this sort seem out of place in an essentially historical work.

These deficiencies are minor when seen against the author's really major contribution to an understanding of the roots of nineteenth century technological change. There should certainly be more innovating works of this sort.

* * *

HOW TO ASSESS INVESTMENT PROPOSALS*

A Review

By

Seymour Smidt
Cornell University

The main purpose of the article under review is to point out a fallacy in the rate of return approach to investment analysis and to suggest a method of calculating the rate of return that corrects this fallacy. In addition, the author, Robert H. Baldwin, a Raytheon Corporation executive, suggests a procedure for appraising the risk associated with an investment.

In the current literature on investment analysis, the words "rate of return" have been applied to almost every ratio measure of investment worth. In the article under review the term carries two distinct menaings. For clarity we will use the term "yield" to refer to the rate of discount that equates the present value of a stream of proceeds with the present value of a stream of outlays. The term "Baldwin rate of return" will be used to describe the measure Baldwin advocates.

Baldwin criticizes the yield method because, as he says, it "assumes that, for the period between the base point and the time when funds are expected or collected, the funds are, or could be, invested at the rate of return (yield) being calculated for the proposal". Baldwin feels future proceeds should actually be discounted at a rate equal to the average return that will be gained on funds reinvested in this company. To correct this deficiency, Baldwin suggests the following: Estimate the net cash flows that will be generated by an investment. Divide the cash flows in any year into two groups; group one may be called Outlays and group two Proceeds (the terms Baldwin uses are Investments and Cash Income). Using the average return that can be earned

* ROBERT H. BALDWIN: Harvard Business Review, Vol. XXXVII, No. 3, pp. 98-104, May-June 1959.

by this company we find the present value of the outlays and the future value of the proceeds as of the terminal date of the investment. The ratio of this future value of proceeds to the present value of outlays is calculated. Then we find the yield of these two cash flows, that is, the rate of interest that, compounded over the life of the original investment, will have the same value as the previously calculated ratio of future values to present values. This is the Baldwin rate of return. Baldwin claims this method of computation "leads to more realistic answers".

To see more clearly what is involved in Baldwin's suggestion, it will be helpful to restate his calculation in symbolic terms. Suppose we have a simple three period investment consisting of net cash flows (outlays indicated by negative numbers and proceeds indicated by positive numbers) of a_0 in year 0, a_1 in year 1, and a_2 in year 2.

Under these circumstances, the ordinary yield of an investment is found by finding the root of the following second order polynomial:

$$a_0 + a_1 \ g + a_2 \ g^2 = 0$$

If g is a real root of such an equation, $0 < g < 1$, then the ratio $(1-g)/g$ is the yield of the corresponding series of cash flows. Roots outside this range have no interesting economic meaning.

The procedure recommended by Baldwin is to divide the net cash flows of any year into two components, which we represent by the symbols b_0 and c_0 for year 0, and similarly for years 1 and 2. The only requirement is that the sum of the components for each year must equal the net cash flow for that year. The b components are referred to by Baldwin as investments. Their present value is found using the average rate of return the company can earn on its investment, to find what might be called the present value of the outlays. That is, we find the value B in the following equation where r represents the average return on the company's investment:

$$B = b_0 + b_1 (1 + r)^{-1} + b_2 (1 + r)^{-2}$$

We also find the <u>future value</u> of the series Baldwin calls income, and which is C in the following equation:

$$C = c_0 (1 + r)^2 + c_1 (1 + r) + c_2$$

Having found the two values B and C, Baldwin recommends finding the rate of interest which, compounded over the life of the investment, would equal the ratio C/B. That is, we are asked to find i in the equation $C/B = (1 + i)^3$. This "i" is the Baldwin rate of return.

To be sure, Baldwin does not recommend arbitrarily dividing the net cash proceeds for a given year into these two groups, but he recommends that the component called investments should consist of outlays for capital equipment, "associated expense", and changes in working capital. The cash income from the project represents the "incremental after-tax earnings", plus "depreciation and amortization of the investment". Although the division of the net cash flows into these components is not arbitrary, investments having identical net cash flows might easily have a different division between investment outlays and cash income, and therefore different Baldwin rates of return. As a matter of fact, there are an infinite number of possible Baldwin rates of return for any series of net cash flows. Why one of these rates of return should have any particular claim in a given instance to being the true measure of the worth of the investment is not clear. So far as the real costs and benefits are reflected in cash flows, it is the net cash flows in each period, not some arbitrary division into investments and income, that is economically significant.

A similar, though by no means identical, analysis was presented by Professor Solomon in 1956. The criterion he recom-

mends,[1] based upon "present value per dollar of outlay", is related to Baldwin's and depends in the same way on an arbitrary division between outlays and proceeds.

In considering the appraisal of risk, Baldwin recommends that the analyst consider a variety of estimates of the value of money and of the economic life of the investment, and calculate a Baldwin rate of return for several such estimates. He also finds limited use for the payback period as a measure of risk.

[1] Ezra Solomon: "The Arithmetic of Capital Budgeting Decisions", The Journal of Business, Vol. XXIX, No. 2, April 1956, pp. 124-127.

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MANAGERIAL ECONOMICS*

Book Review

By

Alan J. Levy
Stevens Institute of Technology

Spencer and Siegelman have written an important and valuable book aimed at three specific classes of readers: graduate students, management consultants, and executives in industry. They present the conceptual basis of the major kinds of business problems, put this into the realistic uncertainty nature of the actual world and then give analytic and practical techniques in handling the problems to arrive at decisions and solutions.

The book is divided into two main sections: The first part outlines the uncertainty framework of managerial decisions and presents the major economic and statistical tools used in solving business problems. The authors show through discussion and example the futuristic thinking that is implicit in managerial decision making. The second part of the book covers the specific areas of management problems: profit management, demand analysis and sales forecasting, production management, costs analyses, pricing practices and policies, competition and control, and capital management. In each chapter the authors sketch out the broad outlines of the problems present in each area, explain the most typical analytic methods used to describe the problems, and then give economic solutions to the problems. These chapters cover a vast range of managerial literature and often the theory and work methods presented only touch upon the barest essentials. What is important is that they cover the central problems and main considerations, leaving those interested in

* MILTON H. SPENCER AND LOUIS SIEGELMAN: Managerial Economics. Decision Making and Forward Planning. Richard D. Irwin, Inc., Homewood, Illinois, 1959. 454 pp. $8.10

deeper examination of any phase with a detailed and evaluated bibliography.

As both a textbook and as a book for men in the practical affairs of business, this is a valuable addition to the industrial literature of our time. In a review, to try to highlight the good points or criticize inadequate attention to a specific problem on technique would fill a great deal of space and say very little. The authors have covered almost everything and they constantly point out that they are only polishing the high spots in each area. No section is covered exhaustively and the student interested in a topic will be required to read further in other texts. The book brings together a vast body of literature and studies that give both an insight into the true managerial problems and offer the best current techniques used to solve them. Yet this very breadth leaves the book open to the criticism of superficiality.

The book naturally lends itself to comparison with Joel Dean's earlier "Managerial Economics".[1] Dean's main emphasis was conceptual and descriptive, and he supplied almost no mathematical material or outlines of specific solutions. Spencer and Siegelman are more concerned with solutions. They use simple mathematical material and develop techniques, so that those experienced in industry can immediately apply the material.

For the practical man, and as a textbook for a graduate class, this book is superior to Dean. It contains good student problems and is more specific in each area. The fact that it is reasonably short also highly recommends it as a textbook. The lecturer can elaborate, as he believes necessary, in each of the areas covered by the authors.

[1] Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 1951.

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CURRENT DEPRECIATION ALLOWANCES: AN EVALUATION AND CRITICISM*

A Review

By

Barnard E. Smith
Stanford University

Under the present high tax rates depreciation allowances often determine whether a particular investment will be made. In making economy studies, we are acutely aware of this, for we can clearly see their effect on the prospective cash flow after taxes.

The avowed purpose of depreciation allowances is to "permit the investor in plant and equipment to recover his investment tax free". In a period of inflation this purpose is only partially accomplished. Under the present tax treatment the investor recovers the dollar base of his investment. Often he finds that this amount is so reduced in purchasing power that it will not pay for replacement plant or equipment; extra funds must be provided out of earnings. This means that a tax has been levied on some "income" which was in reality capital recovery.

It is this problem which Dr. Ryan has analyzed in this well documented booklet. In it he traces the history of depreciation allowances in this country and briefly reviews today's tax provisions concerning depreciation. Then, by examining the trends in investment, depreciation and prices, he clearly and convincingly shows that today's depreciation allowances are failing to provide the nesessary funds for plant replacement.

Dr. Ryan examines the consequences of this failure to recover, tax-free, the equivalent purchasing power during the life

* JOHN RYAN (Studies in Industrial Economics, No. 5): Fordham University Press, New York, 1958. 80 pp. $1.25, paper.

of the asset. He shows that this failure, which is in effect a concealed tax on capital, is a deterrent to modernization. Eventually this process can produce technological stagnation.

To solve this dilemma, two proposals are made. Both involve adjustment of the current basis for depreciation in recognition of the change in price level since the purchase date of the asset. The first is a one-time "blow-up" such as has been done in other countries experiencing inflation. The second method and the one preferred by Dr. Ryan is the use of index numbers to adjust the book value in each year, thus providing continuous adjustment for inflation.

The author reviews several problems which would arise if replacement cost depreciation were to be adopted. Omitted is the important problem of whether the investor would be required to use the same method of computing depreciation in his financial reports as he did for tax purposes. Another question would concern the treatment of salvage values.

Dr. Ryan has done a mammoth piece of research in this study. Unfortunately, his work will not be fully appreciated by many engineers. The engineering view may well be that it is sufficient to correctly analyze a proposal within the existing rules and regulations. Consider, though, that we are in a position to see, first, the economic obstacles to technological improvement. What is our responsibility in this respect?

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* * *

COMMUNICATIONS

On: "Managing Capital Expenditures - Appraisal of Specific Proposals", The Engineering Economist, Volume 4, Number 3, Winter 1959.

By: The author, Professor Gordon Shillinglaw, Massachusetts Institute of Technology.

A question from Mr. H. V. Nyland, of Sinclair Research Laboratories, has called my attention to the following sentence in my article, appearing at the top of page 19 in the Winter 1959 issue of The Engineering Economist: "In any event, the use of present worth calculations also requires uniform time periods for comparisons."

This statement is clearly in error. Although equal time periods are desirable, one of the major advantages of discounting cash flows at a fixed rate rather than computing the internal rate of return or profitability index for a proposal is that the expected lives of mutually exclusive proposals need not be identical.

For example, proposal A has an internal rate of return of 16%, based on an expected life of five years; proposal B has an internal rate of return of 14%, based on an expected life of ten years. Both require the same investment outlay. Direct comparison of these two rates of return is impossible unless it can be assumed that reinvestment opportunities with an internal rate of return greater than 14% will be available at the end of five years. The implicit assumption in rate of return comparisons is that any reinvestment at the terminal date of the shorter-life proposal will be at the same rate of profitability as the initial investment.

The assumption underlying present worth calculations at a fixed rate of discount is that reinvestment opportunities at the end of five years will have an internal rate of return equal to

the fixed rate of discount. If this is true and if the discount rate is 8%, proposal A with five years of earning at 16% and five years at 8% is an inferior investment to proposal B, which promises 14% for ten years.

Of these two methods, the second seems to be in closer agreement with the notion that the firm's rejection rate ought to be equal to the firm's external cost of capital. If the firm operates its capital expenditure program on this basis, it will tend to increase investment up to that point at which the internal rate of return on the least profitable proposal accepted is equal to the company's minimum acceptable rate of return. In other words, the marginal proposal will have a present value equal to zero when discounted at the firm's rejection rate. Under these circumstances it seems inescapable that the evaluation method that assumes the existence of reinvestment opportunities at this minimum rate is preferable to one that assumes reinvestment at a higher rate of profitability.

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1959

A Summer Symposium on "Planning and Justifying Capital Expenditures" was held at Pittsburgh, Pa., on June 13-14th, 1959. It was sponsored by The Engineering Economy Division of The American Society for Engineering Education and The Engineering Economy Research Committee of The American Institute of Industrial Engineers.

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